1-3 AVIATION REGIMENT

Aviation Petroleum Safety

FM 10-67-1, 2
April 98

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Primary Aviation Fuels (AH-64)

US Mil Fuel NATO	Commercial
AVGAS	
JP4 F40	Jet B
JP5 F44	Jet A
JP8 F43	Jet A-1

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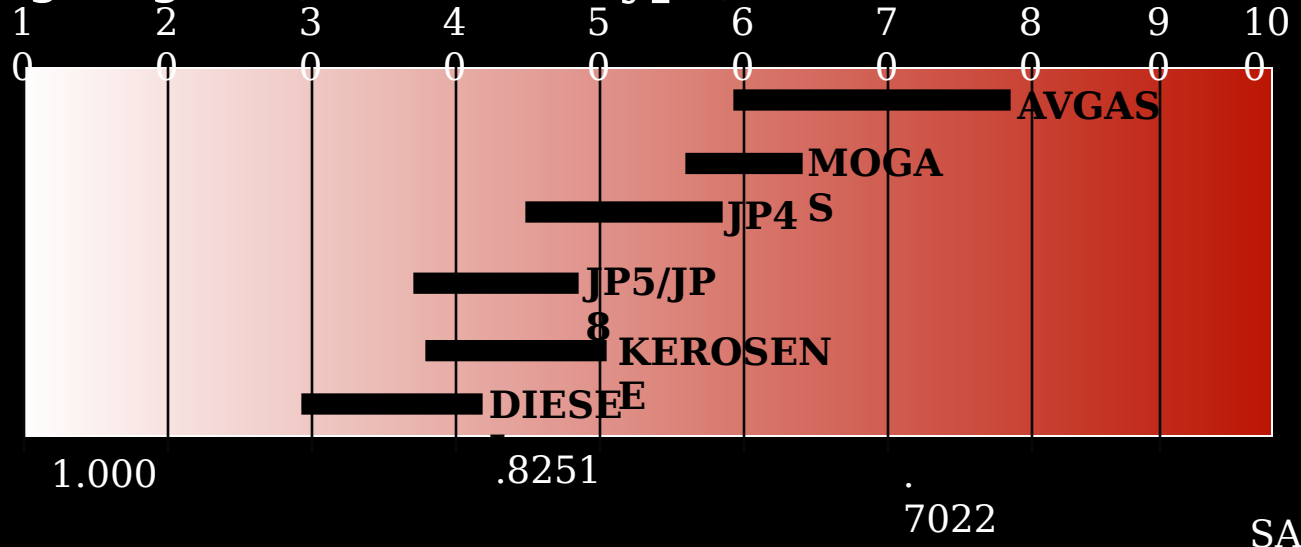
Jet or Turbine Fuels

- Turbine Fuels have an API gravity range of 36 to 57 API
- Boiling point from 100 – 600F

Types of Fuels –

- JP4 (wide cut gasoline type)
- JP5/JP8 (kerosene type)



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Fuel Additives

FSII (Fuel System Icing Inhibitor) –

- **Lowers the freezing point of water to that of fuel**
- **Reduces Microbiological Growth**
- **FSII limit is 0.08 % by volume**
- **Decrease in the FSII volume, decrease in the icing protection**

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Fuel Additives

SDA (Static-dissipating additive) –

- **Increases the conductivity of fuel**
- **Aid to deplete static charge generated during movement**
- **200 – 600 CUs (Pico-Siemens/Meter)**
- **100 – 700 CUs acceptable**
- **<100 increase the risk of explosion**
- **>700 adversely affects fuel probes**

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CI - NEW STUFF!!

- **Attaches itself to metal surfaces such as the interior of a fuel lines.**
- **Reduces the effects of water and particulate contamination from corroding the interior surface of fuel lines**
- **Provide lubricity to fuel wetted parts.**

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Quality Surveillance

Quality and Cleanliness of turbine fuel is vital to the safety operation of turbine-engine powered aircraft.

- **Turbine-engine use high pressure, complex metering equipment to measure fuel over a wide range of altitudes, speeds, and powers.**

- **High fuel consumption rates (AH-64 2.25 gpm@910PPH)**

Rapid accumulation of contaminates and sediments

Sediment may block and erode critical fuel control systems

Free Water may freeze at higher altitudes

Salt water corrodes and may effect aircraft

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Quality Surveillance

- **Fuel must be contaminate free prior to placement in an aircraft fuel system.**

- **Turbine engines cannot remove fine sediment, excessive amounts of sediment, or water from fuel.**

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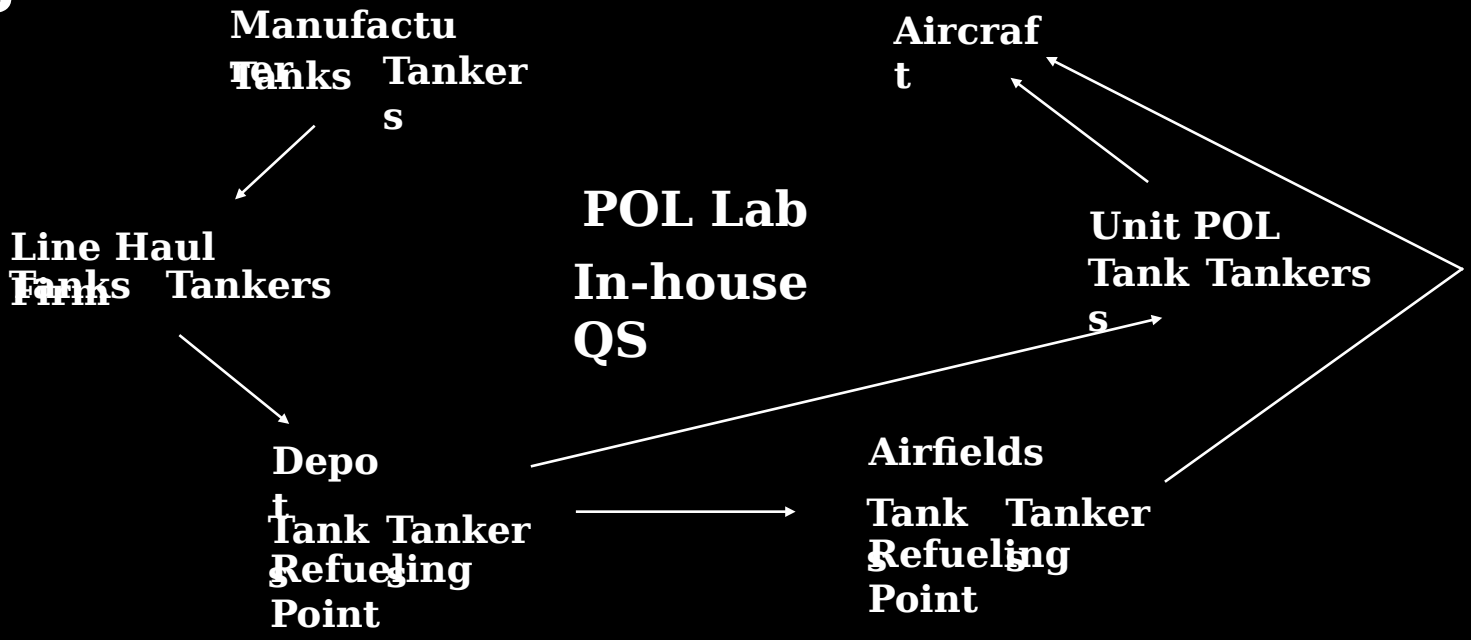
Responsibility

Any unit that has military-owned aviation fuel is responsible for establishing and maintaining an adequate quality surveillance program.



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Common Contamination Hazards

Sediment – may originate from tanks, pumps, hoses, people, and the air.

- **Coarse Sediment –**
  10 microns or larger (25,400 microns = 1 inch). 40 microns visible.
  Settles out of fuel easily
  Remove by adequate filtering
  Hazards:
  Will Clog nozzles screens of fuel delivery and aircraft fuel systems.
  Causes premature wear in fuel controls and injection equipment.

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Common Contamination Hazards

Fine sediment – Smaller than 10 microns

Filtering only effective to a limited degree.

Filtered via centrifuge

Hazards:

Accumulates in fuel controls forming a dark

shellac-like surface on sliding valves.

Forms sludge which causes fuel injection

equipment to operate sluggishly

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Common Contamination Hazards

Water – Two types (fresh or salt). Both may be present as dissolved or free water.

Free water is removed by adequate filtering.

Seen as a cloud; emulsion; droplets; or in large amounts .

Hazards:

Free Water.

Engine flameouts

Freeze and causing fuel starvation

Erroneous engine/fuel system instrument readings

Corrodes aircraft fuel system

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Dissolved Water - absorbed by the fuel (molecularly bonded)

- **cannot be seen or separated.**
- **Settles out of fuel when fuel is cooled.**
- **Hazards present after transformation to free water.**

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Common Contamination Hazards

Microbiological Growth

- No water – no microbes
- Stringy or fibrous black, brown, or gray matter
- Organisms hold rust and water in suspension
- Act as stabilizing agents for water-fuel emulsions
- Suspensions cling to glass and metal causing faulty fuel readings
- Cause fuel controls to operate sluggishly
- MBG is an indication that fuel filters

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Common Contamination Hazards

Commingled Fuel

- Engines are designed to burn one particular type of fuel
- Consequences range from small variations in performance to total loss of power and engine failure.
- Consequences depend on the physical properties of the fuel.

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Quality Control

- Laboratory Testing
- Preflight Sampling and Testing
- Testing Fuel in Aircraft Tanks

Laboratory Testing –
Test Procedures IAW MIL-HDBK-200, FTMS, or ASTM

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Quality Control

Ensures:

- **Fuel meets specifications**
- **Unknown contaminates are identified**
- **Existing or potential contaminates are identified**
- **Field test are corroborated**
- **Identify fuel that are off-specification**

Each agency, installation, and unit must submit samples to a supporting laboratory

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Laboratory Testing

Sample are submitted IAW Military Hand Book 200F when:

- **Requested by petroleum offices**
- **Fuel quality is questionable**
- **Local classification is not possible or need corroboration.**
- **When a filter separator is placed in service, after change, and each moth thereafter.**

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Preflight Sampling

Conducted by the unit/organization responsible for fuel handling.

Test identify the most common forms of fuel contamination

- **Commingling**
- **Particulate matter**
- **Water**

Types of testing: API Gravity, Millipore, Aqua-Glo, Fibrous Material

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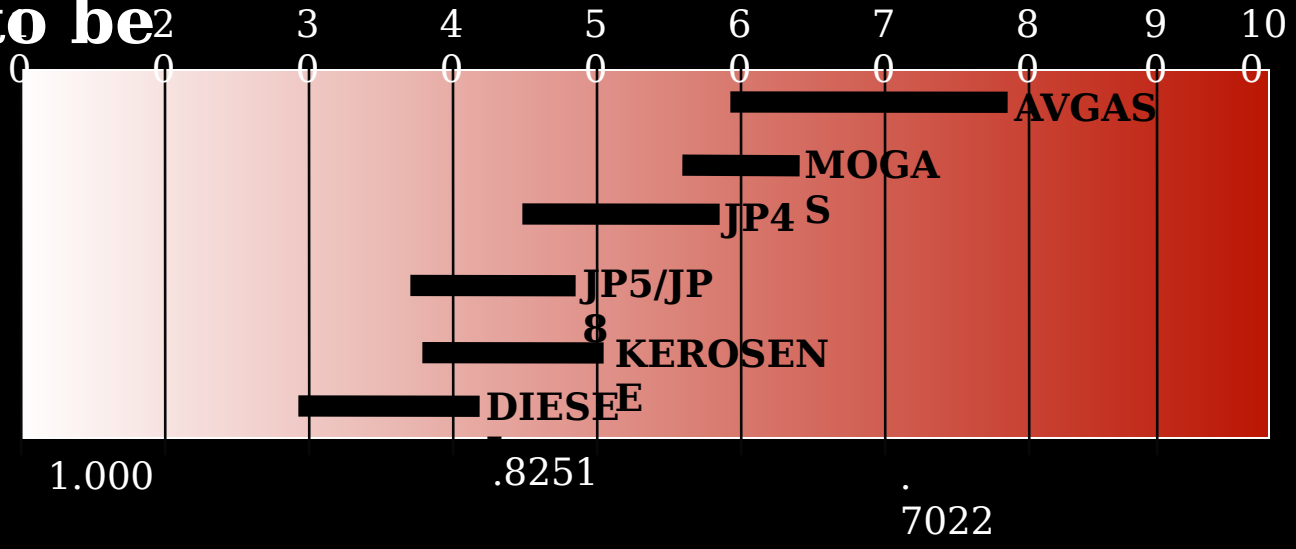
Preflight Sampling

API Gravity Tests –

- **Each type of fuel has a particular API gravity**
- **API indicates fuel is what it is <u>supposed</u> to be**



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Preflight Sampling

Millipore –

- **Particulate Contamination test**
- **Single membrane filter for daily tests**
- **Double membrane used for submission monthly fuel samples**

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Preflight Sampling

Aqua-Glo –

- **Test for the presence of water**
- **Limit 10ppm**
- **Indication of Filter/Separator Failure**

Fibrous Material –

- **Indication of an unserviceable filter/separator**
- **No more than 10 fibers per 1 quart sample**

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Testing Fuel in Aircraft Tanks

These QC checks are performed by aircrew personnel

- **Color – Dependant on type**
  Leaded fuels dyed –
  Red – AVGAS Grade 100/130
  Green – AVGAS Grade 80/87

- **Unleaded fuels not dyed –**
  Color will very from white to amber

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Testing Fuel in Aircraft Tanks

- Color indicates freshness and uniformity – not quality

- Off color could indicate contamination

- Cleanliness and brightness –
  Fuel should be clean and bright
  Free from visible sediment, cloud, haze, emulsion, or free water

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Testing Fuel in Aircraft Tanks

Cloud or haze –

- **Could indicate water or large quantities of fine sediment.**
- **Definite indication of a faulty filter/separator**
- **The source unit serviced and the fuel recirculated to dispensing**
- **Cloudy fuel is not acceptable**

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Testing Fuel in Aircraft Tanks

Sediment –
An indicator of –

- **Faulty Filter/Separator**
- **Contamination source downstream of the F/S**

Occasionally some sediment will be present

Fibrous Material – < 10 fibers per quart

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Sources of Ignition

Concern due to the characteristics of Aviation Fuels

	JP4	JP5/8
Flash Point	-10.F - +30.F	95.F - 145.F
Auto Ign. Temp.	470.F – 480.F	440.F - 475..F
Heat of Combustion	18,700 BTU pp	
Rate of Spread	700 – 800 fpm	100 fpm
Specific Gravity	0.78	

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Sources of Ignition

Electrostatic Susceptibility

- **JP4 and JP8 builds up more static electricity than AVGAS**

- **These fuels are more likely to discharge static through a spark**

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Sources of Ignition

Engines –

- **Static Electricity**
- **Dangers**

Electrical Circuit -

- **Electrical Arcing**

Radar -

- **Heating Solid Material**
- **Intensifying charge/stray current**

Open flame –

- **50 feet rule!!**

Tools and equipment –

- **Spark producing equipment**

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Sources of Ignition

Static Electricity –

Two unlike materials touch or rub

Simply an exchange of electrons

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Sources of Ignition

Static Electricity Hazards –

Sparks from Fuel

Impurities, hoses, filters, pipes, pumps, etc…

Static charge may increase 10 to 200%

Sparks in Fuel Tanks

Introducing vapors in new or repaired fuel tanks

NOTE: External tank storage procedures

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Sources of Ignition

Sparks from Aircraft

Air movement over aircraft metal surfaces will cause a static charge

Induced charge during flight near clouds

Taxiing/Roll-on/off

Sparks from Vehicles

Static charge from movement (air)

Static charge from loading fuel

Sparks from personnel and clothing

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Sources of Ignition

Human body conducts electricity

Dry atmosphere, build and hold a charge of several thousand volts

- **Moist climate aids dissipation**
- **Synthetic/Wool clothing hazardous**
  - **Absorb body charge**
  - **Build charge through friction**
  - **Electrical tension or voltage increases to extremely dangerous levels**

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FUEL SOAKED!!!

Footwear – Worn soles (nails)

Bond Yourself! Become one with an inanimate object.

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Sources of Ignition

Lightning Strikes

Release of stored charge

Stop Refueling when lightning is in the immediate area

5 NAUTICAL MILES!!

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Grounding & Bonding

Safety Measures to minimize/eliminate static electricity–

<u>Dissipate or Bond</u>

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Grounding & Bonding

Bonding –

- **Two conductive objects are connected to lessen potential differences.**
- **It equalizes the charges on two unlike objects.**

Grounding –

- **Provides a conductive path which dissipates static charges harmless into the ground.**
- **Grounding rod must reach a level of permanent ground moisture**

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Grounding & Bonding

Grounding and Bonding Methods –

Method 1 - Use of tested ground point

Method 2 – Use of tactical/temporary ground rod

Method 3 – Bonding only

(Command Authorization)

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Fire Safety

Flash Point

-10.F - +30.F/+95.F - +145.F

Auto Ignition Temperature

470.F – 480.F/ 440.F - 475..F

Heat of Combustion

18,700 BTU per pound

Rate of Spread

700 – 800 fpm/100 fpm

Specific Gravity

0.78/0.81

Electrostatic Susceptibility: Up

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Fire Safety

Petroleum fires: Class B

CO2, HALON 1211, Purple K, Foam

Serviceability!!
Extinguisher will be present at each point, pump, and if possible at tanker/source.

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Fire Safety

Concerns: Heat 18,000 BTU

Can I get close?

Wind:

Can I get the agent to the flame?

Agent:

Is the agent effective?

Do I have enough to extinguish the fire

Better yet – Save personnel's lives?

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Fire Safety

Planning for emergencies is essential.

- **A fire plan should be prepared for each site.**
- **MEDEVAC Plan**

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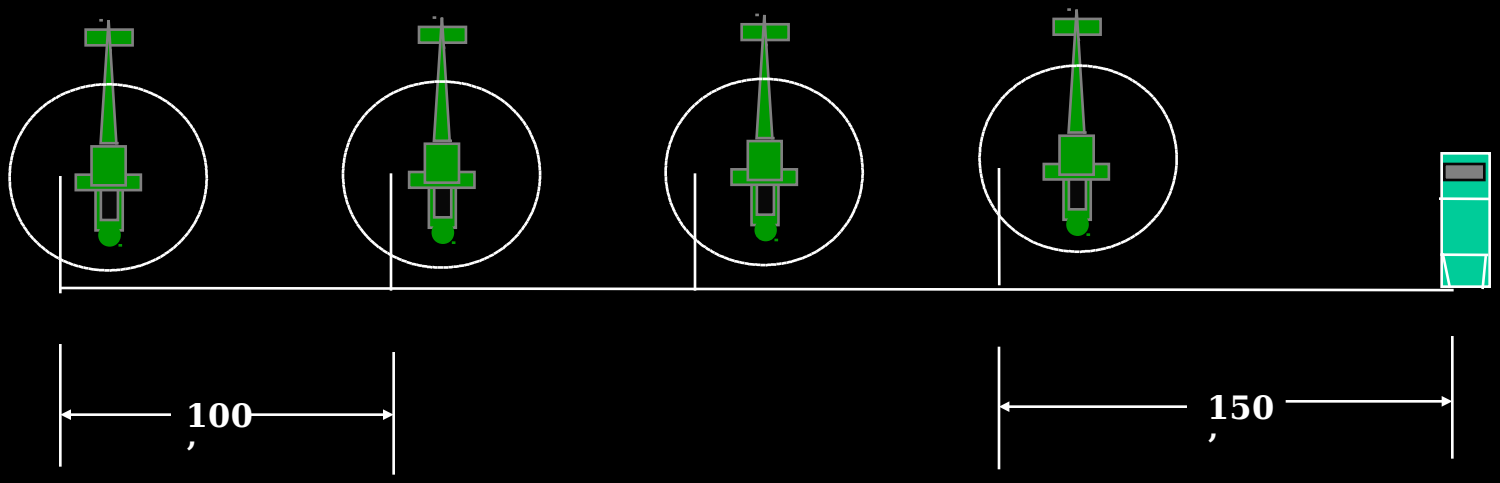
FARP LAYOUT



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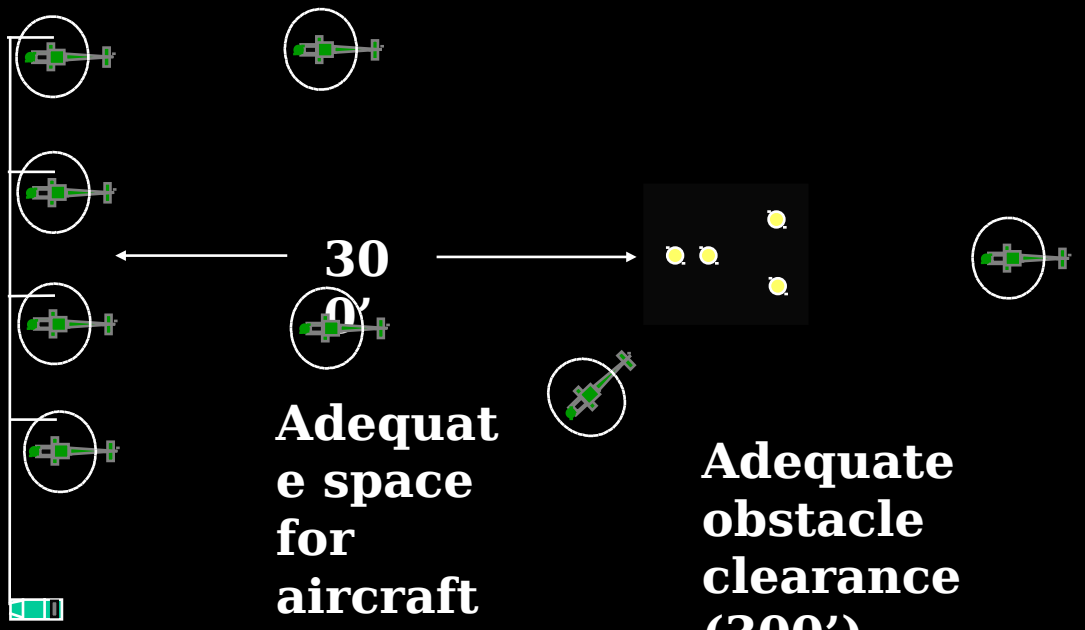

Area free of obstacles

Adequate space for aircraft movement

Adequate obstacle clearance (300')

Establish holding Area to alleviate congestion

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Any ?s

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The End